is evaporated to dryness, dissolved in water, and the clear solution is precipitated by means of silver nitrate and nitric acid; the precipitate is washed, collected on a filter, and dried at 100° C.; it is then ignited in a silver dish, with pure sodium hydrate and potassium nitrate. The fusion products are dissolved in water, and the solution is treated with hydrochloric acid and barium chloride, to precipitate the sulphuric acid formed by the oxidation of the sulphocyanic acid. From the weight of the barium sulphate precipitate the amount of sulphur originally present in the sulphocyanide is then calculated. *Lafayette B. Mendel.*

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SULPHONAL. — (*Dimethyl-methane-diethyl-sulphone*) $(CH_3)_2C(SO_2C_2H_5)_2$. Sulphonal was not placed in the Pharmacopœia on account of its being a proprietary article. It is official in the British Pharmacopœia as "a product of the oxidation of mercaptol, obtained by the oxidation of acetone and mercaptan." It forms in colorless, odorless, and nearly tasteless prismatic crystals; soluble in 450 parts of cold water and 15 parts of boiling water. It is soluble in 50 parts of alcohol.

Professor Kast introduced it in 1888 as an hypnotic, and it has proved so efficacious that it is now recognized as one of the best drugs we possess for that purpose. It is purely a soporific, and is rarely employed for any other purpose than to procure sleep. It does not influence the body temperature, it has no antiseptic qualities, and as an analgesic is of no practical value. Unlike other narcotics, it has no period of excitement, does not check or alter the secretions or derange the digestive organs, and is almost without any influence upon the heart or circulation. Devoid of these many disadvantages, its success as an hypnotic is readily understood.

The action of sulphonal is directed to the central nervous system as a sedative, inducing a quiet and calm sleep from which the patient awakens refreshed. In the case of animals, when excessive doses are given the sleep deepens into coma, convulsions, and paralysis. Its sedative action extends to the spinal cord, lessening reflex action. In animals the loss of power in the hind limbs may be an early symptom. After absorption sulphonal is decomposed in the system and excreted in the urine in the form of sulphur compounds. Some observers have reported the presence of pure sulphonal in the urine after its free administration. At times sulphonal proves irritating to the kidney, causing lessened secretion and pain. It may also give rise to a peculiar reddish-brown discoloration due to the presence of *hæmatoporphyrine*, which may terminate in death (*British Medical Journal*, 1901, i., p. 1473).

Sulphonal has proved of greatest service where the insomnia is of purely nervous origin, as in neurasthenia, mental depression, overwork, and worry, and has found a field of great usefulness in the various forms of mental disease. When pain is the cause of the sleeplessness, its good effects are greatly modified, but in many forms of neuralgia and pain of a reflex character it may be used with success. Where pain is due to organic disease it has no influence whatever. In the insomnia of acute and chronic disease, and during convalescence from disease, it is of much benefit, but requires to be given with some caution, particularly when there is much debility or prostration, and in the aged. In the sleeplessness of cardiac disease and of other forms of organic or mechanical derangement, it is not of much use. In delirium tremens it has been much used, in many instances with benefit, but in these cases the effect is uncertain, and the dose required is excessive and approaching the limit of its physiological action.

As an hypnotic, the dose is from fifteen to thirty grains. It is usual to commence with fifteen grains and increase the quantity until the proper effect is produced. Ten grains will often be sufficient in the aged and debilitated, or where the insomnia is of a mild degree. Under ordinary conditions thirty grains is a perfectly safe dose, and this quantity is usually required to produce its full hypnotic action. On account of its insolubility the action is slow, and the dose should be administered at least one hour before bedtime in hot solution. Six or eight ounces of boiling water are recommended to dissolve thirty grains. Hot milk and broth may also be made use of; tea and coffee are frequently used, but they undoubtedly, to a certain extent, counteract its effect. It may also be administered in alcohol or any spirituous liquor.

The sedative action of sulphonal on the spinal cord and nerve centres has led to its use in some nervous troubles. In chorea it has been given to children in doses of from two to five grains, and has been followed by a fair percentage of successes. In old-standing cases it has little or no influence.

It is now fully recognized that sulphonal is not without its toxic action, and numerous fatal cases have followed its employment. The simplest symptoms that may arise include drowsiness and stupor, giddiness, vertigo, ataxia of the tongue and muscles of the throat and face, and of the extremities. These symptoms gradually disappear after an interval of from ten to twelve hours, without leaving any ill effects. The more severe symptoms are profound coma, muscular twitchings, paralysis of sphincters, hallucinations, delirium, anuria, great prostration.

An erythematous patch is often produced, accompanied by itchiness and pain. The symptoms of toxic action generally appear after large doses, or after repeating an ordinary dose of thirty grains several times. In some instances, when the patient is debilitated and the subject of some wasting disease, very small doses may be followed by toxic symptoms. It has been remarked that poisonous symptoms are much more frequent in females.

The fatal cases that have been reported were due to overdoses or to the prolonged use of the drug.

In one case (*British Med. Journal*, October 25th, 1890) the patient was supposed to have taken about an ounce of sulphonal. The stupor which followed deepened into

insensibility and anæsthesia, the pupils remaining normal and acting to light, while the conjunctiva was insensitive. Breathing was natural, pulse very slightly disturbed, but the temperature ranged between 100° and 103° F. A profuse perspiration bathed the body, and there was total suppression of urine after the first day. On the third day the breathing suddenly became short and jerky and ceased altogether. Another case is reported (*Medical News*, August 10th, 1890) in which two doses of fifteen grains, given within an hour and a quarter of each other, caused death. The patient was a young insane woman who had formerly been given large quantities of chloral and other hypnotics. No medicine had been given on the day she took the sulphonal. She slept quietly all night, and on the following day was drowsy, but could be roused and made to talk rationally; sleep at once came on when she was left alone. The pulse and respiration were slightly accelerated and the pupils normal. Eighteen hours after taking the medicine the pupils began to contract and her temperature rose to 102° F.; in forty hours cyanosis began, and she died from failure of respiration.

Lépine (*La Semaine médicale*, January 20th, 1893) has collected a series of thirteen cases terminating in death. These patients had taken the drug for periods varying from sixty to over a hundred days in ordinary doses. Severe symptoms suddenly supervened, which would indicate a cumulative action, and death followed within a few days, although the medicine was stopped at once. In some instances very large doses have been taken without causing death; in one case four hundred and sixty-three grains were recovered from after one hundred and fourteen hours' sleep (London *Lancet*, 1889, i., 915). See also *Synthetic Products, Poisoning by.*

Beaumont Small.

SULPHO-PARALDEHYDE, tri-thialdehyde $(C_4H_4S_2)_3$, occurs in crystals, is soluble in alcohol and insoluble in water, and is used in dose of 1–4 gm. (gr. xv.–℥ i.) as a hypnotic. *W. A. Bastedo.*

SULPHO-SALINE SPRING.—Hamilton County, Ohio.

POST-OFFICE.—Cincinnati.

ACCESS.—By Elm Street cars to Henry Street, thence one block west.

This well is 2,408 feet in depth and flows in an abundant and continuous stream at a temperature of 62° F. An analysis by Professor Wayne, of Cincinnati, shows the following ingredients: One United States gallon contains (solids): Magnesium carbonate, gr. 9.13; calcium carbonate, gr. 19.34; calcium sulphate, gr. 29.20; potassium sulphate, gr. 2.30; sodium phosphate, gr. 1.34; sodium chloride, gr. 534.77; magnesium chloride, gr. 17.27; calcium chloride, gr. 22.19; potassium chloride, gr. 3.95; magnesium bromide, gr. 0.39; magnesium iodide, gr. 0.30; iron oxide, gr. 0.43; silica, gr. 0.79; loss, gr. 0.76. Total, 642.16 grains. This analysis shows the presence in considerable amounts of valuable ingredients. The water is well adapted for the treatment of portal congestion, hemorrhoids, metallic poisoning, etc. In the form of baths it is useful in many of the chronic skin affections and in advanced syphilis. A very elegant and elaborate bath-house has been fitted up and supplied with all the modern appurtenances of such an establishment. *James K. Crook.*

SULPHUR.—Sulphur is used in medicine in the condition of fine powder, three styles of which are official in the United States Pharmacopœia, as follows:

SULPHUR SUBLIMATUM, *Sublimed Sulphur.*—This preparation, commonly called *flowers of sulphur*, is crude sulphur purified by distillation in an apparatus so arranged that the vaporized sulphur shall condense in the form of a powder upon the walls of the receiving chamber. Sublimed sulphur is a fine, citron-yellow powder, of a slight, characteristic odor, and generally of a faintly acid taste and an acid reaction. It is insoluble in water or alcohol. When ignited, it burns with a blue flame, forming sulphur dioxide gas. Sublimed sulphur always contains a little sulphuric acid, whereby it is unfitted for internal medicinal use.

Sulphur Lotum, Washed Sulphur.—This preparation is simply sublimed sulphur freed from contaminating sulphuric acid. The sulphur is digested for three days with diluted ammonia water, by which process the sulphuric acid is fixed as ammonium sulphate, and the mass is then thoroughly washed with water upon a muslin strainer. The ammonium sulphate is thus washed away, and the purified sulphur is finally dried at a gentle heat, and passed through a No. 30 sieve. Washed sulphur is a fine, citron-yellow powder, odorless and almost tasteless, insoluble in water or alcohol. When derived from a sulphur originally obtained from metallic sulphides, washed sulphur may contain the very dangerously contaminating substance, arsenic, in the form of the trioxide or trisulphide of that element. Proof of absence of arsenic is afforded by digesting a sample of washed sulphur with two parts of ammonia, filtering, and finding the filtrate unaffected by supersaturation with hydrochloric acid, and not precipitated by passing through it a stream of hydrogen sulphide.

SULPHUR PRECIPITATUM, *Precipitated Sulphur.*—This preparation, formerly known as *milk of sulphur*, is an exceedingly fine powder of sulphur, gotten by precipitating with diluted hydrochloric acid a solution of sulphur salts of calcium, obtained by mixing sublimed sulphur and slaked lime with water. The sulphur, after precipitation, is collected upon a strainer, thoroughly washed with water, and dried at a gentle heat. Precipitated sulphur is a very fine, yellowish-white, amorphous powder, odorless and almost tasteless, insoluble in water or in alcohol. Precipitated sulphur should stand the same tests for absence of free acid and of contaminating arsenic as washed sulphur (see above). This variety of sulphur powder differs from the foregoing in being lighter in color and of finer particles. From the latter fact it derives the advantages of greater smoothness and readiness of mixing with fluids; but, to offset, it has the disadvantage of tending to develop an acid upon keeping.

Sulphur is insoluble in water and practically so in alcohol, but dissolves in varying proportions in solutions of the alkalies and in oils, fixed and volatile. Because of its insolubility in aqueous fluids, sulphur is practically devoid of physiological activity while under its own form, but, when rubbed in ointment upon the skin or when taken internally, a feebly irritant action appears, presumably due to a sulphide formed in small quantity by the chemicals present in the secretions of the part. What little of an internally taken dose of sulphur is absorbed is also probably in the condition of a sulphide, and the constitutional effects that follow are a feeble reflex of those of the alkaline sulphides (see *Sulphides*). In single, considerable dose the local irritation displayed by sulphur determines increased intestinal activity, showing itself by relaxation of the bowels, but this with but little increase of secretion. The stools are therefore generally composed of solid or semisolid fecal matter, and the operation of the medicine is mild and slow, the call to stool rarely occurring until from six to eight hours after the taking of the sulphur. If habitually used as a laxative, sulphur may induce a low catarrh of the alimentary tract. A disagreeable feature of its internal taking for any purpose is the tendency to the generation of flatus, offensive from the presence of sulphureted gases.

The therapeutic applications of sulphur are as follows: By some it is given internally as a means of getting the constitutional effects of the sulphides in constitutional diseases, but by the majority of practitioners the internal use is in laxative dose only, for a laxative effect. Such dose is from 4 to 12 gm. (℥ i.–iij.), the washed or precipitated preparations being selected, and the powder mixed with molasses or diffused in milk for the taking. Externally, ointments containing sulphur are a good deal used

as mildly irritant applications in skin diseases generally, and, specifically, as efficient parasiticidal dressings in itch. The following ointment is official in the United States Pharmacopœia:

Unguentum Sulphuris, Sulphur Ointment.—This preparation is compounded of thirty parts of sublimed sulphur and seventy of benzoinated lard, thoroughly incorporated. It may be applied without dilution, and is a very commonly used ointment for the treatment of the itch. It has a disagreeable sulphureted smell, which may to a certain degree be masked by the addition of a little of some odoriferous volatile oil. *Edward Curtis.*

SULPHUR DIOXIDE (formula SO_2).—This compound, commonly miscalled *sulphurous acid gas*, is the product of the combustion of sulphur in air. It is a colorless gas, of a well-known characteristic "sulphurous" odor, and is both offensive to the nostrils and intensely irritant to the larynx. Even the fumes of a single burning sulphur match-head easily excite coughing, and air highly charged with the gas is fatal to life. Sulphur dioxide dissolves freely in water—in one-fiftieth of its volume at ordinary temperatures—forming in the process of solution an acid body, *sulphurous acid* proper (H_2SO_3) (see *Sulphurous Acid*).

The medicinally valuable property of sulphur dioxide is its peculiar noxiousness to the vitality of disease germs—a germicidal potency in which this compound, among gases, is rivalled only by formaldehyde, chlorine, and the vapors, respectively, of bromine and of iodine. Yet in its application to disinfect apartments the inherent uncertainties in the general method of aërial disinfection must never be forgotten. Could we be certain that every disease germ present in a chamber would be fully exposed to the action of the disinfectant gas, then we might rely with corresponding fulness upon the disinfection thus attained; but when we bethink us how easily these germs, microscopic in size, may safely be fortified against assaults of a gas by lodgment in cracks and crannies of furniture and fabrics, then we cannot but realize the important truth that even the most thorough aërial disinfection is at best but an unreliable procedure. In this connection the strong and offensive smell of sulphur dioxide is a distinct advantage, since, after fumigation by the gas, a chamber and all articles therein must be thoroughly aired, and thus additionally disinfected before the human nose will permit of their resumed use.

For the determination of the exact germicidal power of sulphur dioxide, very careful experiments were made by Sternberg,[1] by submitting vaccine virus, moistened with glycerin on the one hand, and dried upon ivory points upon the other, to the action, in a closed chamber, of air charged with varying percentages of sulphur dioxide, the exposure ranging from six to twelve hours. After exposure the virus, or the charged ivory points, were used for vaccination side by side with some of the same sample of virus which had not been exposed to the germicide. The general results were that in the case of moist lymph, destruction of infective power followed a twelve-hour exposure to air charged with a proportion of sulphur dioxide such as would be produced by burning three-quarters of a grain of sulphur for each cubic foot of air; and, in the case of the dried virus, similar results followed with an impregnation equivalent to the combustion, per cubic foot of air, of three grains of sulphur. These results accord with common experience, and teach that at least a one-per-cent. impregnation of air with sulphur dioxide will ordinarily be required to sterilize floating germs.

For the practical application of sulphur dioxide as an aërial disinfectant, the gas is most easily and cheaply obtained by burning sulphur, and in calculating the quantity of sulphur required it is obviously wisest to err very far on the safe side. A good rule, therefore, is to allow from two to three pounds for each one thousand cubic feet of chamber to be disinfected. The strength of fumes thus generated being vastly in excess of what is respirable, the procedure is possible only in vacated rooms. In a chamber to be operated upon, therefore, all living creatures must be removed, and every possible outlet for the gas, such as doorways, windows, and chimneys, must be closed, and even cracks and keyholes should be stopped with cotton or pasted over with paper. Then all articles needing disinfection must be thoroughly exposed on all sides to free access of the gas—bureau-drawers being opened, carpets, curtains, and blankets hung over lines across the room, and mattresses ripped open and the hair loosely strewn on the floor. The proper quantity of sulphur, in the form of sublimed sulphur, is then best mixed with one-fortieth of its weight of powdered charcoal, to secure readier combustion, and put into an iron pot, or upon a metal plate resting upon the legs of a half-open pair of tongs set across a wash-tub half full of water. By these precautions all danger of accidental setting of the floor on fire is avoided. A single door being left unsealed, the operator fires the sulphur by a live coal or a teaspoonful of flaming alcohol, and immediately retires, closing and sealing the door behind him. The sulphur is left to burn itself out, and next day the chamber is cautiously entered, the windows are thrown open, and all articles thoroughly aired. It is possible also to generate sulphur dioxide by burning carbon disulphide in a specially constructed lamp, but from the great inflammability of that compound the procedure is not altogether safe, and presents no advantages over the simple method by the combustion of sulphur. A convenient way of burning the sulphur is by use of sulphur candles, so called, in which a wick is incorporated in a moulded mass of sulphur. By lighting the wick sulphur dioxide is generated.

The use of sulphur dioxide as an aërial disinfectant is now largely superseded by the similar use of formaldehyde. *Edward Curtis.*

[1] American Journal of the Medical Sciences, April, 1883.

SULPHUR IODIDE.—Under the title *Sulphuris Iodidum*, Sulphur Iodide, the United States Pharmacopœia recognizes a preparation made by fusing by heat a mixture of one part of washed sulphur and four parts of iodine. The fused mass, after cooling, is broken into pieces and kept in glass-stoppered bottles. These lumps are gray-ish-black in color and have a metallic lustre. They have the odor of iodine and an acrid taste. The substance is practically insoluble in water, but dissolves in about sixty parts of glycerin. Alcohol and ether dissolve out the iodine and leave the sulphur. On exposure to the air, also, iodine is gradually lost.

This substance is differently regarded by chemists, some considering it a definite compound, corresponding to the formula I_2S_2, and others thinking it more probably a mere physical mixture. If a true chemical compound, it is one of exceptional instability, as the foregoing narration of its properties makes evident. To the therapeutist it presents itself practically as a joint representative of free sulphur and free iodine. It has occasionally been given internally for the purposes for which iodine is so administered, but the commoner employment is external as a gently irritant, iodized application in various skin diseases. It is best applied in the form of ointment made with lard, containing the sulphur iodide in the proportion of about eight per cent.
Edward Curtis.

SULPHURIC ACID.—Oil of Vitriol, H_2SO_4. This well-known acid is official in the United States Pharmacopœia under the title *Acidum Sulphuricum*, Sulphuric Acid, and is defined to be "a liquid, composed of not less than 92.5 per cent. of absolute sulphuric acid, and not more than 7.5 per cent. of water" (U. S. P.). Sulphuric acid is a heavy liquid of an oily appearance, colorless when newly made, but apt to acquire a smoky hue upon keeping. The specific gravity varies in different samples, but a gravity of 1.835 is recognized as standard by the United States Pharmacopœia. The acid has an intense affinity for water. Mixed with that fluid, it unites therewith with the evolution of considerable heat and with a contraction of volume, forming a clear solution. By reason of the same affinity, many organic bodies are decomposed upon treatment with sulphuric acid, the acid abstracting from their molecule the elements of water. Thus, by dehydration, oxalic acid is chemically broken up, alcohol is converted into ethylene gas (C_2H_4), wood and sugar are blackened, and textile fabrics and animal tissues are destroyed. Sulphuric acid, if diluted, also attacks most of the common metals, the prominent exceptions being gold, platinum, and iridium. Certain of the metals, such as copper, mercury, antimony, bismuth, tin, lead, and silver, are also acted upon by the concentrated acid, if the same be heated.

Upon the living animal system strong sulphuric acid acts purely as a powerful caustic. Its action is a spreading one, and the sloughs have a dusky or blackish hue, quite different in color from the yellow sloughs produced by nitric or hydrochloric acid. Swallowed in any quantity, the strong acid is an intense corrosive poison.

Therapeutically, strong sulphuric acid is occasionally used as a caustic, but the very intensity of its action is in its disfavor, so that nitric acid is generally preferred. The acid must be kept in glass-stoppered bottles.

Diluted, so as not to be corrosive, sulphuric acid, like all sour acids, tends to check acid, and to increase alkaline secretions, to inhibit fermentations, and, of course, to neutralize alkalinity. Dilute preparations of sulphuric acid are, therefore, available to repress morbid sweatings, both applied locally as lotions, and given internally to allay thirst and quicken appetite; to prevent fermentation of food in the *primæ viæ*, and so to cure diarrhœas due to the irritation of the products of such fermentations, and to neutralize the alkali of alkaline pyrosis. For these various purposes the following official preparations of the United States Pharmacopœia are available:

Acidum Sulphuricum Dilutum, *Diluted Sulphuric Acid.*—This preparation is a simple aqueous dilution of sulphuric acid, of ten-per-cent. strength. It is a colorless fluid, intensely sour of taste, and of about the specific gravity 1.070. It should be kept in glass-stoppered bottles. This grade of acid, although not corrosive, is quite irritant, and, for medical use, requires considerable further dilution. The dose is from ten to thirty drops, diluted thirty- or fortyfold, and to be taken through a tube, with the mouth well rinsed after the swallowing.

Acidum Sulphuricum Aromaticum, *Aromatic Sulphuric Acid, Elixir of Vitriol.*—This preparation consists of alcohol charged with sulphuric acid and tincture of ginger, and flavored, in addition, with a trace of oil of cinnamon. It contains about twenty per cent., by weight, of sulphuric acid. The preparation is a limpid, yellow fluid of an aromatic, ethereal, and strongly sour taste, and of specific gravity about 0.939. As its odor suggests, it probably contains some ethereal product of a reaction between the acid and alcohol of its composition. The United States Pharmacopœia considers, thus, that there is a certain amount of ethyl-sulphuric acid present. Aromatic sulphuric acid should be kept in glass-stoppered bottles.

This preparation is the favorite one for the internal administration of sulphuric acid. It is to be given in the same manner as the dilute acid (see above), and in the same or somewhat lesser doses. *Edward Curtis.*

SULPHURIC ACID, POISONING BY. See *Acids, Mineral, Toxicology of.*

SULPHUROUS ACID.—H_2SO_3. Sulphur dioxide gas (SO_2) is readily absorbed by water, and in so dissolving is to be regarded as uniting with water, molecule for molecule, with the formation of the acid body, H_2SO_3. The United States Pharmacopœia recognizes under the official title *Acidum Sulphurosum*, Sulphurous Acid, an acid representing not less than 6.4 per cent., by weight, of sulphur dioxide, and of specific gravity not less than 1.035. Sulphurous acid is a colorless fluid, smelling pungently of sulphur dioxide, and tasting both sulphurous and sour. It has a strong acid reaction, and first reddens and then bleaches litmus paper. It is wholly volatilized by heat, and tends constantly to undergo conversion into sulphuric acid by the absorptions of oxygen. This change is hastened by the action of light, hence the Pharmacopœia directs that sulphurous acid be put up in glass-stoppered, dark amber-colored bottles, and be kept in a cool and dark place. The pharmacopœial process for making the acid is to generate sulphur dioxide by heating a mixture of sulphuric acid and charcoal, and to conduct the mixed sulphur and carbon dioxides into distilled water. The sulphur dioxide dissolves in the water with the formation of sulphurous acid, and the carbon dioxide mostly escapes.

In its medicinal properties sulphurous acid resembles sulphur dioxide (see *Sulphur Dioxide*), and may practically be regarded, indeed, as a simple aqueous solution of that compound. It is a pretty potent germicide, and upon tender surfaces of the animal body is decidedly irritant. It bleaches vegetable colors. The acid is used, externally, as a wash in parasitic skin diseases, generally diluted two- or threefold, and, internally, is occasionally prescribed in cases of pyrosis and sarcinæ. It is, however, an exceedingly disagreeable medicine to take. The dose is 4 gm. (about one fluidrachm) of the official acid, taken in a wineglassful of water. *Edward Curtis.*

SUMACH or **SUMAC.**—Smooth Sumac. (*Rhus glabra*, U. S. P.) The dried ripe fruit of *Rhus glabra* L. (fam. *Anacardiaceæ*). This very handsome shrub or small tree grows abundantly in dry places throughout the greater part of North America. It is well distinguished by its smooth young branches from the stag-horn sumac (*R. typhina* L.) upon which they are velvety, and it bears little resemblance to other species. R. copallina has the leaf rachis winged between the leaflets. The poison sumac (*R. vernix* L.; see *Poisonous Plants*) has smooth green or yellowish-green fruits, in very loose open panicles, while that of *R. glabra* occurs in very large and very dense pyramidal masses. The commercial fruits are about a sixth of an inch long and broad, and somewhat flattened, ovoid, obtuse, truncate at the base. The epicarp is of a deep crimson color and glandular-tomentose, and contains a single smooth yellowish stone. The hairy covering is strongly acid and astringent. The hairs are rather short and matted, those of the stag-horn sumac being shaggy. The drug contains two different classes of constituents, imparting distinct medicinal properties, besides the fatty oil of the seeds. About two per cent. or three per cent. of tannic acid and a very little gallic acid make it a mild and useful astringent, while its malic acid renders it distinctly refrigerant. For the latter purpose it is now scarcely employed, although it was largely so during earlier periods, when lemons and similar refrigerant fruits were less readily obtainable in country districts. As an astringent, sumac berries are usually employed for gargling, in various forms of sore throat, and are frequently combined with chlorate of potash. The acid taste renders this more grateful than other throat astringents. The drug is also often used as an intestinal astringent. The official preparation is the fluid extract, which contains ten per cent. of glycerin, and the internal dose of which is 2 to 4 c.c. (fl. 3 ss.–i.). This is commonly diluted with from one to three parts of water, to be used as a gargle, though the decoction and infusion are more commonly employed for that purpose.
Henry H. Rusby.

SUMBUL.—U. S. P. (*Sumbul Radix*, B. P., *Muskroot.*) The dried root of *Ferula Sumbul* Hook., f. (fam. *Umbelliferæ*). This large perennial herb, belonging to the asafœtida-, galbanum-, and ammoniacum-yielding group of the family, and inhabiting the same general region, has a large, rather short cylindrical root, attaining a diameter of four or five inches, and a length of say a foot, when it divides into several stout branches. The root itself as a perfume, and afterward as a medicine, appeared in Europe about 1840.

Sumbul occurs in transverse segments, varying in diameter from about 2 to 7 cm., and in length from 15 to 30 mm.; light, spongy, annulate or longitudinally wrinkled; bark thin, brown, more or less bristly fibrous; the interior whitish, with numerous brownish-yellow resin dots and irregular, easily separated fibres; odor strong, musk-like; taste bitter and balsamic.

Constituents.—The most important constituent is the *resin*, of which there is nine per cent. (Flückiger); it has a musky smell, more developed in contact with water, and a bitter, aromatic taste. The root contains also a small quantity of dull-bluish-colored oil.

Action and Use.—Sumbul has not any important medicinal value; like asafœtida, and its namesake, musk, it is gently stimulant and slightly antispasmodic, and may be given for the same nervous conditions as they; but its principal employment is in the preparation of some perfumes, where it takes the place of musk. A tincture (*Tinctura Sumbul*, strength one-tenth) is official.

W. P. Bolles.

SUMMERVILLE, SOUTH CAROLINA.—This popular winter resort, among the pines, is situated in the southeastern portion of the State, twenty-two miles northwest from Charleston. Its favorable features as a health resort are its dry sandy soil, pine forests, equable mild temperature, and freedom from the enervating heat peculiar to points farther south. The pines are an especial feature of the place, and abound not only about the town but are thickly scattered throughout it "in the middle of the streets, on the sidewalks, in the gardens, and in fact everywhere." There are local laws prohibiting the cutting down of these trees. The atmosphere is permeated with their balsamic odor, and if there is any virtue in such a naturally medicated air it must surely be found here.

The population of the town is about 5,000 souls, and there are various churches, schools, shops, good markets, etc.

The sanitary condition is carefully supervised by an efficient board of health, of which Dr. A. H. Hayden is president, to whom the writer is indebted for climatic and other information contained in this article. Tuberculosis is included in the list of contagious or infectious diseases required to be reported to the board, and whenever in a hotel or any other building a case of consumption has "lived, resided or died," it must be reported in writing to the secretary of the board of health; and "immediately upon receipt of each report, the health officer shall, at the expense of the occupant or owner of the premises, cause said premises to be at once fumigated and properly disinfected." [Extract from the Rules and Regulations of the Board of Health.]

The natural drainage is excellent, and this is supplemented by an open canal, on one side of the town, some miles in length, and into this accessory canals or ditches empty. Soil carts are also employed by the town.

The water supply is very generally derived from open wells, although the Pine Forest Inn and Pinehurst (Tea Farm) have artesian wells.

The accommodations are good, there being several first-class hotels and many boarding-houses.

The outdoor attractions and amusements are walks and drives among the pines, golf, many excursions in the vicinity to various historic and ancient landmarks,—old churches, plantations, and the like,—the Pinehurst Garden Park, with its large variety of ornamental trees and shrubs, and the Pinehurst Tea Gardens where the tea plant is successfully grown. Twenty-two miles distant is Charleston, with all its attractions in and about the city. There are also opportunities for shooting and fishing.

The subjoined meteorological table affords an index of the various climatic features. It will be seen that the winter temperature is comparatively mild, the mean maximum and minimum temperatures not extreme, and a large majority of the days are sunny, so that one can be out of doors the most of the time. The mean average annual rainfall for nineteen years was 56.76 inches, and for the four years of the chart, 59.16 inches. On account of the character of the soil the ground is quickly dry after the heaviest rainfall. The average relative humidity appears high, but it is said that there is no sensation of dampness in the atmosphere. According to Dr. W. H. Prioleau, of Summerville (*Therapeutic Gazette*, September, 1897), the climate is most beneficial to invalids from October to May, "for during that time there is bright sunny weather, and the atmosphere changes are seldom so sudden as to cause any serious anxiety or discomfort." "The town is near enough to the sea coast," says the same authority, "to cause the atmosphere to lose the aridity of a sandy plain; at the same time sufficiently distant to be free from all dampness."

* Climate of Summerville, S. C.—Period of Observation from January, 1899, to January, 1903.

	November.	December.	January.	February.	March.	April.	July.	September.	Year.
Temperature—Degrees Fahr.									
Average mean	59.3°	47.5°	46.8°	46.6°	54.4°	59.2°	80.1°	72.5°	
Average maximum	79.5	74.7	74.8	76.2	81.2	83.7	96.2	91.0	
Average minimum	39.5	19.0	21.4	16.7	27.6	34.7	65.2	53.5	
Mean maximum	66.5	58.7	58.4	56.3	67.7	68.1	88.3	82.7	
Mean minimum	51.2	46.2	36.8	37.1	44.9	50.2	71.2	65.2	
Average daily range	15.3	12.5	21.6	19.2	22.8	17.9	17.1	17.5	
Average monthly range	51.2	55.0	53.4	57.4	53.6	49.0	31.0	37.5	
Humidity— (The humidity was recorded only a portion of the period.)									
Average relative	77.4%	76.8%	70.8%	70.9%	72.5%	73.0%	83.5%	79.5%	
Precipitation—									
Average in inches	2.77	3.73	3.49	4.67	3.01	4.08	5.25	3.56	59.16
Wind—									
Prevailing direction	N. E.	S.W.-N.E.	S. W.	S., N. W.	S. W.	S. E.	S. W.	N. E.	N.E., S.W.
Weather—									
Average number of clear days	18.2	15.0	13.0	10.4	13.4	15.7	15.2	19.7	
Average number fair days	6.7	7.5	9.2	10.0	11.2	9.2	12.5	5.2	
Average number clear and fair days	24.9	22.5	22.2	20.4	24.6	24.9	27.7	24.9	
Average number cloudy days	5.0	8.2	8.8	7.6	6.4	5.0	3.2	5.0	

Frost occurs from November to April, with ice and occasional snow in the coldest months of the year.

* These data were obtained through the kindness of Dr. A. H. Hayden, of Summerville, S. C.

The diseases and conditions for which this climate is suitable are pulmonary tuberculosis in the early stage, laryngitis, bronchitis, asthma, influenza, neurasthenia, and insomnia. Further, it is a favorable place for a winter residence for the many who, for one reason or another, desire to escape the cold of the North or West. "I must admit," says Elizabeth Stuart Phelps, writing in *McClure's Magazine*, "that Summerville is a land of lovely dreams, with more conveniences and fewer discomforts, more tonic and less enervation than any other Southern health or pleasure resort I have seen. Roses run riot over it; its homes are gardens, and gardens are its homes. There the winds are laid. . . . There it is always dreamland, and there the knotted Northern nerves may relax and rest."

One can reach Summerville by various railroad routes or by water from New York to Charleston and from thence by rail. The time from New York by rail is twenty-four hours.

Edward O. Otis.

SUMMIT SODA SPRINGS.—Placer County, California.

Post-Office.—Summit Soda Springs. Hotel and cottages.

Access.—Viâ Central Pacific Railroad to Summit station, thence by stage or carriage, twelve miles to the springs. The location is near the summit of the Sierra Nevada Mountains, at an altitude of 16,000 feet above the sea-level. The region is one of picturesque grandeur, and the magnificent view from the neighborhood of the springs is unobstructed for miles around. The air is pure, dry, and invigorating, being cool and pleasant all the summer. The springs are situated in an expansion at the head of a deep canyon, along which winds one of the forks of the American River. The hotels and cottages are pleasantly located, and good bathing facilities are at hand. Two analyses have been made. They are as follows:

One United States Gallon Contains:

Solids.	Dr. Winslow Anderson, 1888. Grains.	J. T. Randolph, 1878. Grains.
Sodium chloride	26.18	26.22
Sodium bicarbonate	4.11	....
Sodium carbonate	5.75	9.50
Potassium carbonate	.82	Trace.
Magnesium carbonate	4.05	4.20
Calcium bicarbonate	38.93	43.20
Calcium carbonate	6.55	....
Ferrous oxide	....	1.75
Ferrous carbonate	2.70	....
Borates	Trace.	....
Alumina	1.13	1.75
Silica	1.94	2.06
Organic matter	Trace.	....
Total solids	92.16	88.68

Free carbonic acid gas, 187.25 cubic inches (saturated).

The water has antacid, diuretic, aperient, and tonic properties, and is useful in the treatment of dyspepsia, torpidity of the liver and bowels, Bright's disease, stone in the bladder, etc.

James K. Crook.

SUNDEW. See *Droseraceæ*.

SUPERFŒTATION.—Ordinary multiple pregnancy is generally the result of the simultaneous fertilization of more than one ovule. Should such fecundation be *successive* instead of *simultaneous*, it is called *superimpregnation*. Of this, there are two varieties: (1) *Superfecundation*, which occurs when two (or more) ovules belonging to the *same* period of ovulation are impregnated by successive acts of coitus. (2) *Superfœtation*, which occurs when two or more ovules belonging to *successive* periods of ovulation are impregnated, so that a woman who is already pregnant becomes again pregnant a month or more later, and carries simultaneously in the uterus both these products of conception. Thus a second ovum is fertilized after the first has been developing for a month or more, and the two fœtuses continue to develop simultaneously and independently.

The term *superimpregnation* has been used in two senses: (1) as a generic term including both superfecundation and superfœtation; and (2) as synonymous with superfœtation or superfecundation. We believe the former to be the more correct usage, though the term might well be abolished.

Superfecundation is now well recognized, and needs no discussion. There have been reports of too many well-authenticated cases to allow of any doubt on this point. The most conclusive proofs are furnished by those cases in which a black woman has at the same time given birth to twins, of different colors, the one a mulatto and the other black, and whose features have unmistakably indicated their paternity. In many of these instances the mother has explained that both a white man and a black man had had intercourse with her within a short interval of each other. Similar, but not so frequent, are the reported cases in which a white woman has had intercourse successively with a white man and a black man, and has given birth to twins of different colors and races. Illustrative cases in abundance may be found in the pages of works on medical jurisprudence, notably those of Tidy and Beck.

But *superfœtation* has not been so readily admitted. Like other theories which have subsequently crystallized into facts and been accepted, the possibility of superfœtation has been alternately asserted and denied. Thus, according to Beck, Brassavolus, who lived between 1500 and 1555, said that he had known *superfœtation to be epidemic!!!* By later physicians, the possibility of superfœtation was generally accepted, and many cases were brought forward to support the claim; but it is doubtful how many of these cases would stand the test of a thorough investigation at the present day; and some of them are certainly capable of much simpler explanation. The next stage was that of vigorous denial. This view has been taken by Lusk, who says: "That impregnation can take place at two periods distant from one another—must be regarded as an inadmissible hypothesis, until physiologists shall succeed in demonstrating in a single instance, by the presence of corpora lutea of different ages, that ovulation ever occurs during pregnancy" ("Midwifery," 1896). No doubt ovulation does ordinarily cease during pregnancy; and this may be one of the reasons why there are so few cases of superfœtation. But that ovulation can occur during pregnancy has been demonstrated by Christopher (*Am. Jour. of Obstet.*, 1886), who also cites Slavjansky's case, as follows: "Professor Slavjansky, of St. Petersburg, in a laboriously exact paper in the *Annales de Gynécologie*, vol. ix., furnishes a report of a very interesting and instructive case. A woman, twenty-four years of age, had menstruated since her seventeenth year, and had been delivered of a child three years previous to her present pregnancy. Her last menstruation occurred November 5th, 1876, but conception is supposed to have taken place early in December. Death occurred March 23d, 1877, from a rupture of the left Fallopian tube, due to tubal pregnancy. The legal autopsy was made thirty hours after death, and the generative organs afterward given to Slavjansky for examination. He found on the left ovary a tumefaction which presented a cavity 1 to 3 cm. in diameter, and on microscopic examination presented all the characters of a Graafian follicle. The contents, which had been coagulated by alcohol, were carefully separated by a needle, and on examination under the microscope were found to be the cells of the discus proligerus, and within them was found the ovule with its eccentrically situated germinal vesicle and germinal spot clearly marked. In the cortical substance of this ovary were found numerous Graafian follicles in all degrees of development, from the primordial follicle up to the follicles of 0.3 cm. in diameter. A corpus luteum of 0.4 cm. in diameter was found immediately under the principal cavity. In the cortical substance of the right ovary were numerous follicles of varying degrees of development, one being 0.3 cm. in diameter. A recent corpus luteum 1 cm. in diameter was clearly outlined in the surrounding tissues." Of even more value, and apparently unassailable, is Cosentino's case: "A woman in the sixth month of pregnancy died of heart disease. The ovaries were subjected to a careful microscopic examination, and in them were found